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(54) **HYDRAULIC DEVICE FOR DRIVING AND GUIDING OF A LONGITUDINAL TOWING MEMBER, ESPECIALLY A PULLEY OF A FORESTRY WINCH**

HYDRAULISCHE VORRICHTUNG ZUR ANSTEUERUNG UND FÜHRUNG EINES LÄNGLICHEN ZUGELEMENTS, IM BESONDEREN EINER RIEMENSCHEIBE EINER FORSTSEILWINDE

DISPOSITIF HYDRAULIQUE POUR CONDUIRE ET GUIDER UN ÉLÉMENT DE HALAGE LONGITUDINAL, EN PARTICULIER UNE POULIE DE TREUIL FORESTIER

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Description

[0001] The invention refers to performing operations and transporting, especially to driving assemblies of winches and hoisting devices, forestry winches or similar mainly in a horizontal direction operating devices, and in particular to construction details of such devices. O the other hand, such an invention also belongs to elements of machines and transmissions, in particular to rope pulleys, belt pulleys and chain wheels.

[0002] The aim of the invention is to create a hydraulically powered driving and guiding assembly, namely a rope pulley or a belt pulley or a chain wheel, in particular a hydraulically powered rope pulley adapted for unwinding the rope from a forestry winch drum, by means of which efficiency of unwinding the rope or similar longitudinal towing member from corresponding winch drum should be improved and simultaneously also looseness of the rope due to unwinding the drum could be eliminated.

[0003] In forestry winches the winding drum is usually driven by means of a tractor engine via a Cardan shaft and appropriate gearbox. In addition, at least heavy duty winches are furnished with a hydraulic circuit comprising a hydraulic power unit located either on the tractor or even on the winch itself. Consequently, at least drums of heavy-duty winches may comprise an essential amount of a relatively thick rope wound thereon, which then results in essential inertia, so that unwinding of the rope from such drum upon releasing the brake is extremely difficult, so that an auxiliary pulley is foreseen, which is hydraulically powered. Such pulley is placed on a shaft, which is essentially in a horizontal position embedded within a casing, which is allowed to be pivoted around its vertical axis. A hydraulic motor is mounted on said casing and protrudes away from said casing, so that the width of such powered pulley assembly in the area of the axis of rotation is extremely high. Such extreme width of the pulley together with corresponding motor may often hinder operation of the winch in situ, and also transport of the winch as such by simultaneously influencing the appearance of the whole device.

[0004] For the purposes of interpretation of the present invention and in particular of the scope thereof, the expression "*a flexible longitudinal towing member*" should be understood to mean any flexible and essentially linearly extending bearing member, which is capable for transmission of forces in at least one axial direction thereof, wherein the group of such members includes in particular ropes, including metallic wire ropes, belts, including flat belts, V-belts or otherwise profiled belts, as well as chains, including link chains and stud i.e. Gall's chains. Accordingly, the term "a hydraulic driving and guiding assembly of a longitudinal towing member" should be understood to mean a hydraulically powered assembly for driving each of the aforementioned longitudinal towing members, by which the phrase "Hydraulic media" means any liquid or gaseous substance, which is capable to transform accumulated pressure energy into mechanical energy, in particular into rotation of said driving member.

[0005] US 3,843,094 discloses a traction device comprising a drum and a pinch roller. The roller and drum rotate together and drive the cape between the two.

[0006] A device for unwinding a rope from the winch drum is described in DE 20 2005 020 694 U1. Such device comprises a pulley, which is powered by means of a hydraulic motor and the rope intended to be unwound from said drum is extended via such pulley. The pulley is placed on a shaft, which is embedded within appropriate casing and is interconnected with a shaft of a hydraulic motor, by which the stator i.e. the casing of said motor is co-axially attached to the casing of the pulley. A rotor of said hydraulic motor is mounted on a shaft, which is either connected to the pulley shaft, or may also protrude within the pulley casing in order to enable mounting the pulley directly onto the hydraulic motor shaft. Regardless to that the overall dimensions of the pulley casing and the surmounted hydraulic motor are in each case huge, which is deemed to be one of the main deficiencies of such devices. In addition to that, it has to be taken into consideration that the pulley is intended to assist unwinding of the rope from the winch drum, and that the length of the rope wound onto such winch drum may really be essential. The drum as such must be sufficiently rigid, so that the moment of inertia of the drum as such is also essential. Moreover, an essential amount of the rope having an essential weight is then wound onto such drum, so that inertia of the drum together with the rope wound thereon Is still essentially larger. Consequently, it may be expected that from time to time upon activating a hydraulic motor and upon the pulley has started to rotate the rope is sliding on the surface of the pulley, while the drum remains in place without any turning and enabling herewith the rope to start unwinding. Such problems appear in particular when the rope is wet and dirty, which may arise very often by exploitation the winch by performing various forestry operations *in situ.* In order to increase a required friction between corresponding surfaces of the pulley and the rope, according to DE 20 2005 020 694 U1 appropriate pressing rollers should be placed adjacent to the pulley, which are rest on the surface of the rope in order to press the rope towards the surface of the pulley and to increase the friction there-between. Each of said rollers is freely rotatable embedded in appropriate bearing member, which is eccentrically pivotable embedded on the pulley casing and pressed towards the surface of the pulley by means of a spring. A desired tension of the spring and consequently of the pressing force acting towards the surface of the pulley may be adjusted by means of a corresponding screw. Thanks to such measure, the friction between the rope and the pulley may actually be increased in certain extent, while simultaneously another problem arises, which is even worse. As soon as thanks to said pulley the drum has started to rotate and the rope has started unwinding there-from, the drum remains rotating around its axis.

When said unwinding should be terminated upon each desired length of the rope has been unwound from the drum, the hydraulic motor of the pulley is deactivated and the pulley should stop rotating. Regardless to that, the drum having essential inertia is unable to stop rotating at that very moment and still needs certain time upon terminating the rotation of the pulley to stop, which is actually not desired, but is in the practice unavoidable. During said stopping period, a certain length of the rope is still unwound from the drum, which however not pulled outside from the casing of the drum but remains in a quite loose state still present within said casing. Since such metallic rope is relatively rigid and also relatively resilient, in such a loose state it may be bent into certain shape, which merely depends on tendency of the rope as such rather than on any other parameters e.g. the weight of the rope or the like. Quite often, the rope in such circumstances may easily form a loop. Consequently, as soon as the winch drum is activated by an user again in order to enable towing of each respective load, the winch drum starts to pull previously loose portion of the rope, which is then placed onto the surface of the drum in a quite sporadic manner and merely depending on each position, in which the rope hay been previously formed. If in such situation the rope could be wound onto the surface of the winch in a regular manner, this would really be a coincidence. It is however believed that under a much higher probability the rope should start to be wound in any other location and under irregular angle, wherein a result of such irregular winding is the facts that certain sections of the rope are cross-like overlapped, which may result in problems during winding and/or unwinding and in particular in damages of the rope after a quite short time period.

[0007] The present invention refers to a hydraulic driving and guiding assembly of a longitudinal towing member, comprising at least one main driving member, which is rotatable around its geometric axis by means of a hydraulic motor and is in the area of bearings or similar bearing members embedded within appropriate casing.

[0008] According to the invention, the problem above-mentioned of the prior art are solved by means of features as included in patent claims, wherein said main driving member is attached to an inside of the casing protruding and therein embedded rotatable part of a hydraulic motor, such that the transmission of torque between them is enabled, while its stationary part is attached to the casing.

[0009] An auxiliary driving member is foreseen on said casing, which is situated adjacent to the main driving member and may rotate around the axis extending parallel with respect to the axis of the main driving member so that the rope or a similar flexible towing means extends between said driving members, wherein a gear is attached to the main driving member and another gear is attached to the auxiliary driving member, by which said gears are adapted to be engaged with each other.

[0010] The stationary part of the hydraulic motor is an integral part of the casing. Besides, said the stationary part of the hydraulic motor protrudes axially into the casing and is furnished with outside the casing situated hydraulic connections, and is moreover surrounded with a rotatable part of said hydraulic motor, which is embedded within the casing by means of bearings and to which on its circumference a driving member is attached. Said rotatable part of the hydraulic motor is embedded within said casing by means of two bearings, which are situated axially apart from each other, whilst the driving member is situated on said rotatable part between said bearings.

[0011] The driving member is selected from the group consisting of rope pulleys, belt pulleys and chain wheels.

[0012] Now the invention will be described in more detail on the basis of two embodiments, which are shown in the enclosed drawings, wherein

- Fig. 1 is a top view of a hydraulic driving and guiding assembly of a flexible longitudinal towing member, namely a pulley for a forestry winch
- Fig. 2 is a cross-section in the plane II - II according to Fig. 1;
- Fig. 3 is a perspective view of a further, still improved embodiment of a forestry winch;
- Fig. 4 is a partial cross-section of the embodiment according to Fig. 3; and
- Fig. 5 is a diagram of hydraulic system for controlling the assembly according to the invention.

[0013] It should be annotated that despite to numerous and various possible embodiment of the invention, it will be presented exclusively on the basis of exploitation thereof in the field of driving pulley for forestry winches.

[0014] In this quite practical embodiment a pulley is used as a main driving member 1 of an assembly for driving and guiding of a longitudinal towing member, namely of a steel rope 5 (Fig. 2), which is in the shown embodiment also guided by an auxiliary guiding member 6, wherein said pulley is allowed to rotate around its at least approximately vertical axis 10 and is embedded within a casing 2, which is pivotally around a vertical axis 20 attached to the housing of a forestry winch, which is not shown in the drawing.

[0015] According to the invention, a hydraulic motor 3 comprising hydraulic connections 30', 30" is embedded within said casing 2 in such a manner that its centrally arranged stationary part 32 is on the one hand firmly interconnected with said casing 2 and on the other hand surrounded with a rotatable part 31, which is driven by means of hydraulic media and is by means of bearings 41, 42 embedded within the casing 2. The driving member 1 is placed on the circumference of said rotatable part 31 of the hydraulic motor 3 and is interconnected therewith in any reasonable manner, which enables transmission of torque and that any the rotatable part 31 of the motor 3 is prevented from being displaced relatively to the driving member 1 in the circumferential direction.

[0016] As soon as said hydraulic connections 30',

30" are connected into a hydraulic circuit and a pressure is established in the hydraulic media, said driving part 32 of the hydraulic motor 3 together with the driving member 1 attached thereto thanks to bearings 41, 42 rotates within the casing 2 around the axis 10. In contrary to previously known devices, where the driving member 1 is mounted on the shaft, which is coaxially connected to rotatable part 31 of the hydraulic motor 3, which is attached to the casing 2, in this particular case the hydraulic motor 3 is mounted within the casing 2, while the driving member 1 is attached to the rotatable part 31 of the motor 3, so that the width of the whole assembly, namely of the casing 2 with the driving member 1 mounted therein as well as with the hydraulic motor 3, may be essentially reduced without any doubt.

[0017] Whenever the pulley is foreseen for the purposes of guiding the rope 5, by means of which relatively high loadings should be transferred, then the friction between the rope 5 and the pulley i.e. the driving member 1 may be increased by means of an auxiliary driving member 7 (Fig. 3) arranged adjacent to the driving member 1, so that the axis of the member 1 and the axis of the member 7 extend parallel to each other, while the rope 5 is extending between both driving members 1, 7. Said auxiliary driving member 7 is driven by the firstly mentioned driving member 1. To this aim, a gear 15 is coaxially connected to the driving member 1, and a gear 75 is coaxially connected to the auxiliary driving member 7, by which said gears 15, 17 are adapted for mutual cooperation. Diameters of said gears 15, 75 are correspondingly adapted to diameters of said driving members 1, 7, so that the velocity on the circumference of the driving members 1, 7 is equalized and cooperation thereof with the rope 5 extends without sliding.

[0018] For the purposes of being adjusted to each available diameter of the rope 5 and in particular also for the purposes of adjusting pressure of said auxiliary driving member 7 towards the surface of the rope 5 and indirectly also a pressure between the last and the surface of the driving member 1, the distance between the axis of the driving members is adjustable and may e.g. be pre-determined. For such purpose, said auxiliary member 7 with its axis is embedded on a bearing member 71 on the casing 2, and may be displaced towards the driving member 1 or apart from it by means of a threaded bush 72 supported by a spring 73, whereupon said driving member 7 is fixed in each desired position by means of a nut 74.

[0019] Whenever the pulley is used in a forestry winch, such winch comprises a not shown winding drum adapted for winding or unwinding the rope 5. Such drum is normally driven via appropriate transmission gear, to which a driving shaft of a tractor or similar working machine. As known to those skilled in the art, in such a case the drum comprises a clutch and a brake in an alternating operation relationship, which means that when the clutch is activated, the brake is deactivated, by which torque is transmitted from the shaft of the working machine to the drum, which is correspondingly rotated in each desired direction of winding or unwinding the rope 5. As soon as winding or unwinding of the rope 5 is finished, the clutch is deactivated and the brake is activated, by which the drum is prevented from being further rotated. Operation of the clutch and brake is controlled by means of a hydraulic assembly 8 comprising hydraulic cylinders 81, 82 intended to control operation of the brake and clutch.

[0020] As previously mentioned, in particular during unwinding the rope 5 from the drum there is a problem, since during the braking stage due to inertia of the drum certain amount of rope 5 is still unwound, by which also the rope 5 due its resiliency shows certain tendency in the course of remaining within the drum casing, so that the rope 5 remains within the casing in various positions and loose, but after that, i.e. when the drum starts rotating in a direction of winding the rope 5, it is wound onto the drum in an inappropriate manner.

[0021] For the purpose to avoid this phenomena, according to the invention the hydraulic motor 3 intended to drive a pulley according to the invention is integrated into a hydraulic assembly 8 serving to control operation of the brake and the clutch. To this aim, the hydraulic assembly 8 in addition to a reservoir 83 for hydraulic media, a pump 84, said cylinders 81, 82 for controlling operation of the brake and the clutch, comprises also a hydraulic motor 3 together with a corresponding pressure storage unit 85, which is in a serial manner connected with said hydraulic motor 3. In this, said hydraulic motor 3 and the belonging pressure storage unit 85 are mutually interconnected within the hydraulic assembly 8 in such a manner, that by activation of the hydraulic cylinder 81 of the brake and the hydraulic cylinder 82 of the clutch in order to deactivate said brake or said clutch, supplying the pressure from the reservoir 83 via the pump 84 is terminated, upon which the hydraulic motor 3 is supplied with the pressurized media from the pressure storage unit 85. Consequently, as soon as supplying of the pressurized media towards the cylinders 81, 82 and the hydraulic motor 3 is the interrupted by means of a control valve 86, by which the brake is activated and the clutch is deactivated in order to terminate rotation of the drum, the hydraulic motor 3 is temporarily still further supplied with the hydraulic media stored within the pressure storage unit 85 and is therefore still able to drive a driving member 1 and indirectly also the driving member 7, by which the rope 5, which has remained within the drum casing, is forwarded outwards from said casing, so that each relevant section of the rope 5 between the drum and the driving members 1, 7 in the pulley according to the invention remains permanently tensioned.

[0022] Upon switching said control valve 86 in order to enable supplying of hydraulic media towards the cylinders 81, 82 of the brake and the clutch and also towards the hydraulic motor 3 of the pulley according to the invention, the hydraulic media is primarily supplied towards the pressure storage unit 85 and after that also towards the cylinders 81, 82 as well as towards the hydraulic mo-

tor 3, wherein such sequence is achieved e.g. by means of throttle members 87, 88.

Claims

1. Hydraulic driving and guiding assembly of a longitudinal towing member, comprising at least one driving member (1), which is rotatable around its geometric axis (10) by means of a hydraulic motor (3) and is in the area of bearings (41, 42) or similar bearing members embedded within appropriate casing (2), **characterized in that** the driving member (1), is selected from the group consisting of rope pulleys, belt pulleys and chain wheels, is attached to an inside of the casing (2) protruding and therein embedded rotatable part (31) of a hydraulic motor (3), such that the transmission of torque between them is enabled, while its stationary part (32) is attached to the casing (2), and that within said casing (2) an auxiliary driving member (7) is foreseen, which is situated adjacent to the main driving member (1) and may rotate around the axis (71) extending parallel with respect to the axis (10) of the main driving member (1), so that the rope (5) or a similar flexible towing means extends between said driving members (1, 7), wherein a gear (15) is attached to the main driving member (1) and the gear (75) is attached to the auxiliary driving member (7), by which said gears (15, 75) arc adapted to be engaged with each other, and wherein the stationary part (32) of the hydraulic motor (3) protrudes axially into the casing (2) and is furnished with outside the casing (2) situated hydraulic connections (81, 82), and is moreover surrounded with a rotatable part (31) of said hydraulic motor (3), which is embedded within the casing (2) by means of bearings (41, 42) and to which on its circumference a driving member (1) is attached.

2. Hydraulic driving and guiding assembly according to Claim 1, **characterized in that** said rotatable part (31) of the hydraulic motor (3) is embedded within said casing (2) by means of two bearings (41, 42), which are situated axially apart from each other, whilst the driving member (1) is situated on said rotatable part (3) between said bearings (41, 42).

Patentansprüche

1. Hydraulische Vorrichtung zum Antrieb und zur Führung eines länglichen Zugelements, aufweisend mindestens ein Antriebselement (1), das durch einen Hydromotor (3) um seine geometrische Achse (10) drehbar ist und im Bereich von Lagern (41, 42) oder ähnlichen Lagerelementen in einem geeigneten Gehäuse (2) eingebettet ist, **dadurch gekennzeichnet, dass** das Antriebselement (1) ausgewählt ist aus der Gruppe bestehend aus Seilscheiben, Riemenscheiben und Kettenrädern, dass es an einem an der Innenseite des Gehäuses (2) vorstehenden und darin eingebetteten drehbaren Teil (31) eines Hydromotors (3) angebracht ist, so dass eine Drehmomentübertragung zwischen diesen ermöglicht ist, während sein feststehender Teil (32) an dem Gehäuse (2) angebracht ist, und dass in dem Gehäuse (2) ein zusätzliches Antriebselement (7) vorgesehen ist, welches angrenzend an das primäre Antriebselement (1) angeordnet ist und sich um die Achse (71) drehen kann, die sich parallel zu der Achse (10) des primären Antriebselements (1) erstreckt, so dass sich das Seil (5) oder ein ähnliches flexibles Zugmittel zwischen den Antriebselementen (1, 7) erstreckt, wobei ein Zahnrad (15) an dem primären Antriebselement (1) und das Zahnrad (75) an dem zusätzlichen Antriebselement (7) angebracht ist, wodurch die Zahnräder (15, 75) dazu geeignet sind, miteinander in Eingriff zu kommen, und wobei der feststehende Teil (32) des Hydromotors (3) axial in das Gehäuse (2) vorsteht und mit sich außerhalb des Gehäuses (2) befindlichen Hydraulikverbindungen (81, 82) versehen ist und des Weiteren von einem drehbaren Teil (31) des Hydromotors (3) umgeben ist, der durch Lager (41, 42) in dem Gehäuse (2) eingebettet ist, und an dem an seinem Umfang ein Antriebselement (1) angebracht ist.

2. Hydraulische Antriebs- und Führungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der drehbare Teil (31) des Hydromotors (3) durch zwei Lager (41, 42) in dem Gehäuse (2) eingebettet ist, die axial voneinander getrennt angeordnet sind, während sich das Antriebselement (1) auf dem drehbaren Teil (3) zwischen den Lagern (41, 42) befindet.

Revendications

1. Ensemble hydraulique d'entraînement et de guidage d'un élément de traction longitudinale, comprenant au moins un élément d'entraînement (1), qui est rotatif autour de son axe géométrique (10) au moyen d'un moteur hydraulique (3) et se trouve dans la zone de paliers (41, 42) ou d'éléments similaires de paliers intégrés au sein d'un carter (2) approprié, **caractérisé en ce que** l'élément d'entraînement (1) est choisi parmi le groupe consistant en des poulies pour corde, des poulies pour courroie et des roues pour chaîne, est fixé sur un intérieur du carter (2) faisant saillie et intégré dans celui-ci une partie rotative (31) d'un moteur hydraulique (3), de sorte que la transmission de couple entre eux est possible, tandis que sa partie fixe (32) est fixée au carter (2), et **en ce que**, à l'intérieur dudit carter (2), un élément d'entraînement (7) auxiliaire est prévu, qui est situé de façon adjacente à l'élément d'entraînement (1) prin-

cipal et peut tourner autour de l'axe (71) s'étendant parallèlement par rapport à l'axe (10) de l'élément d'entraînement (1) principal, de telle manière que la corde (5) ou un moyen flexible de traction similaire s'étend entre lesdits éléments d'entraînement (1, 7), dans lequel un engrenage (15) est fixé à l'élément d'entraînement (1) principal et l'engrenage (75) est fixé à l'élément d'entraînement (7) auxiliaire, ce par quoi lesdits engrenages (15, 75) sont adaptés à être engagés l'un avec l'autre, et dans lequel la partie fixe (32) du moteur hydraulique (3) fait saillie axialement à l'intérieur du carter (2) et est équipée avec des connexions hydrauliques (81, 82) situées à l'extérieur du carter (2), et est de plus entourée avec une partie rotative (31) dudit moteur hydraulique (3), qui est intégrée à l'intérieur du carter (2) au moyen de paliers (41, 42) et à laquelle, sur sa circonférence, un élément d'entraînement (1) est fixé.

2. Ensemble hydraulique d'entraînement et de guidage selon la revendication 1, **caractérisé en ce que** ladite partie rotative (31) du moteur hydraulique (3) est intégrée à l'intérieur dudit carter (2) au moyen de deux paliers (41, 42), qui sont situés axialement espacés l'un de l'autre, tandis que l'élément d'entraînement (1) est situé sur ladite partie rotative (3) entre lesdits paliers (41, 42).

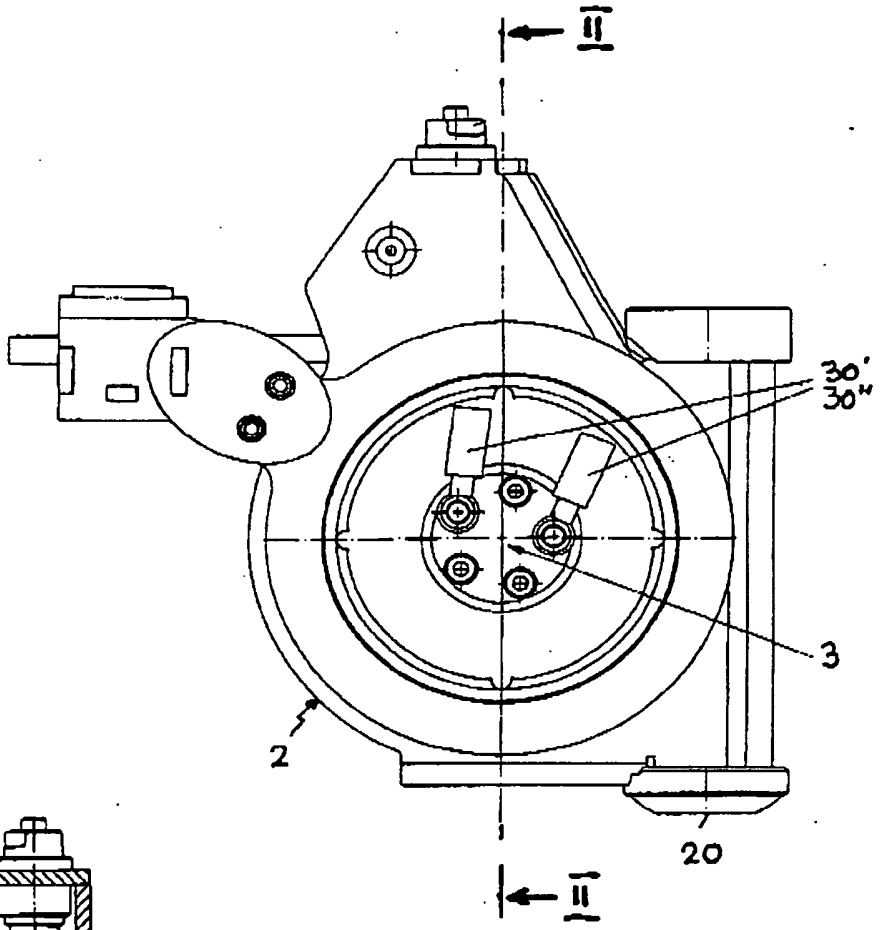


Fig. 1

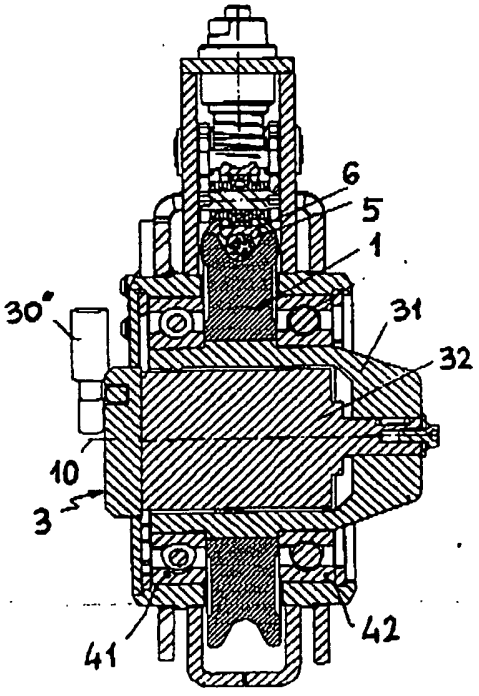


Fig. 2

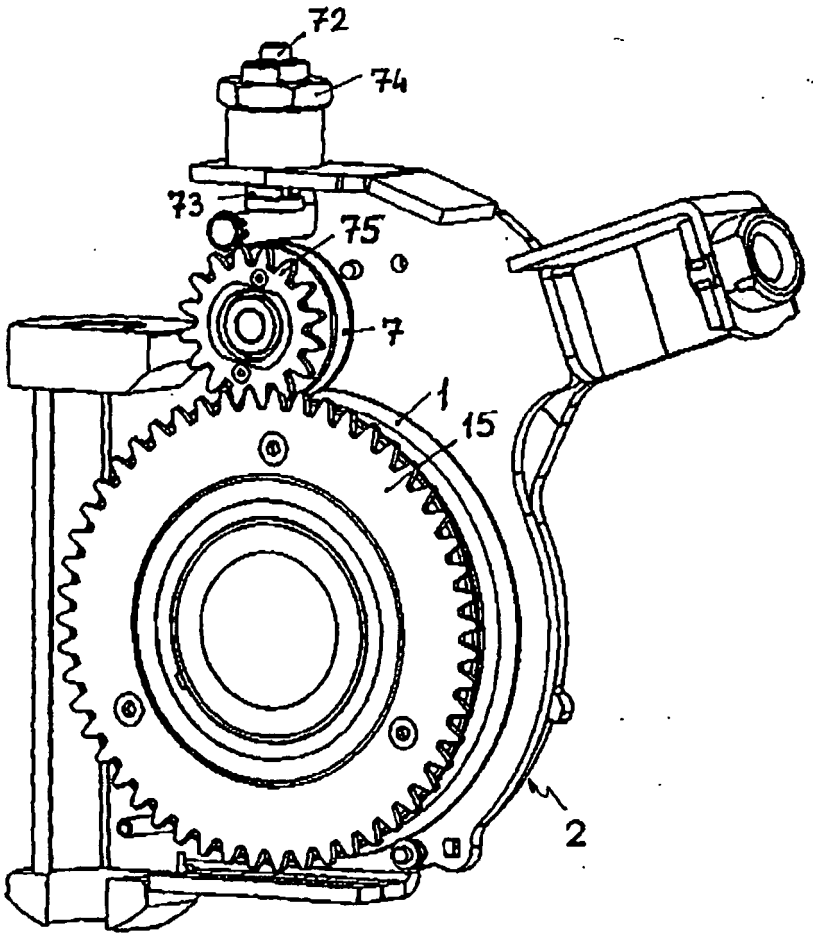


Fig. 3

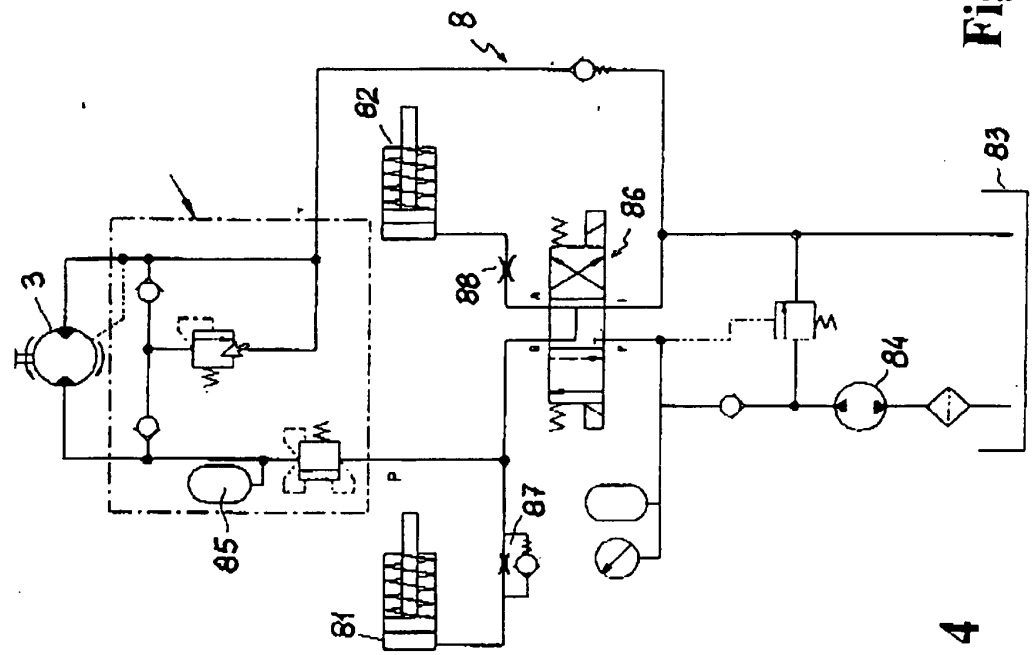


Fig. 5

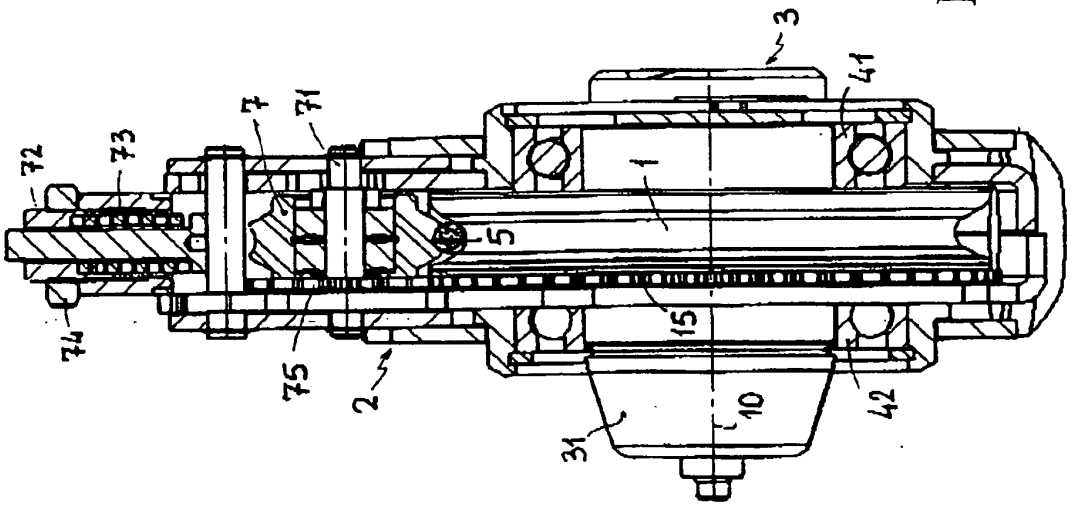


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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